Advance Night Vision Goggles (ANVG)

Night Ops Symposium

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ANVG Description

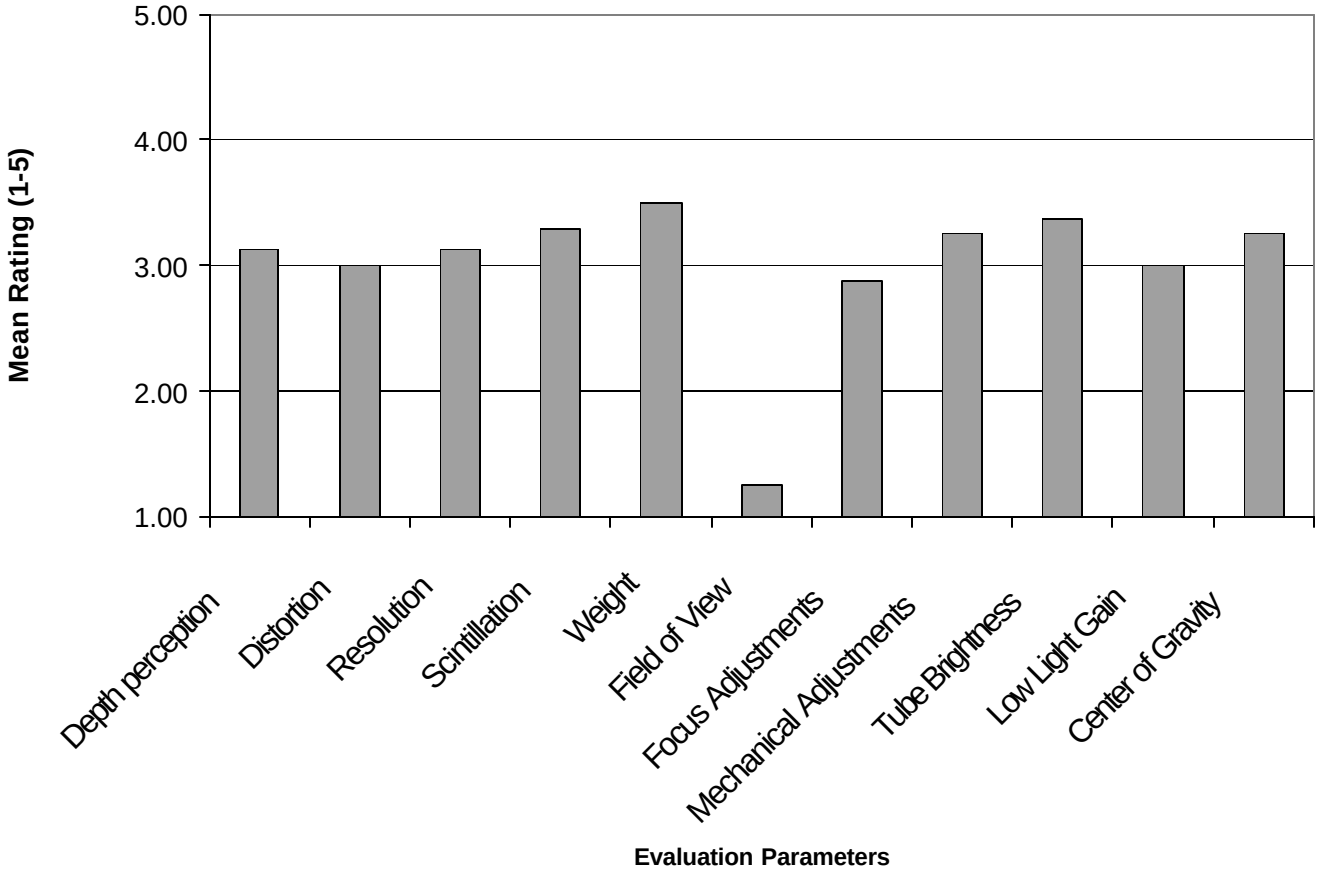
- **ANVG is a modular system designed for both Air and ground applications**
  - Helmet mounted, 40^{o}x100^{o} FOV image intensified goggles with integrated display for symbology. Upgrade to current 40^{o} FOV ANVIS-6.
  - I^2 WFOV goggles with integrated helmet mounted uncooled FLIR for dismounted soldier to replace/complement PVS-7s/14s.

Background/Lessons Learned

- **Conducted Users surveys on fielded NVGs (ANVIS, PVS-7s)**
  - Resolution is adequate
  - Given a choice, maintain current resolution and improve FOV
- **Conducted studies and field experiments to develop design criteria**
- **Air Force SBIR I (~95-96)**
  - Breadboard PNVG, NVESD assisted in I^2 tube and assessed optical, mechanical approach for 100^o FOV
  - NVESD conducted flight assessment at Ft. Carson on FOV and mechanical concept -- Favorable pilots feedback nice CG, nice FOV for increase awareness (Brian Gillespie)
- **Air Force SBIR II (~97- 99)**
  - "PNVG 2" Prototype in Army evaluation
  - With support from ATB and USAARL, helo flight assessment conducted at Ft. Rucker Sep-Dec 99
  - Liked FOV, optical & human interface issues (Bill McLean, CW5 Roberts)
- **ANVG ATD Approved Aug 99, contract award Apr 00 (I-PNVG/ANVG)**

Army Flight Evaluation of PNVGII

Evaluation conducted by the U.S. Army Aeromedical Research Laboratory, Sept 99



ANVIS-6 used as Baseline; 1= much better; 5= much worst

ANVG Design Incorporates User Feedback

- **Human Interface recommendations noted during Evaluation (outer channel focus, tilt adjustments, fit and comfort etc)**
- **Improved optical design for operation in urban environment**
- **Ensure compatibility with existing equipment (gas mask, LEP, etc)**
- **Must maintain current ANVIS performance while providing increased FOV**

Advanced Night Vision Goggles For Army Applications

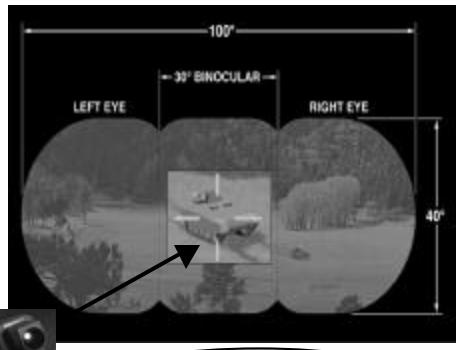
NVESD

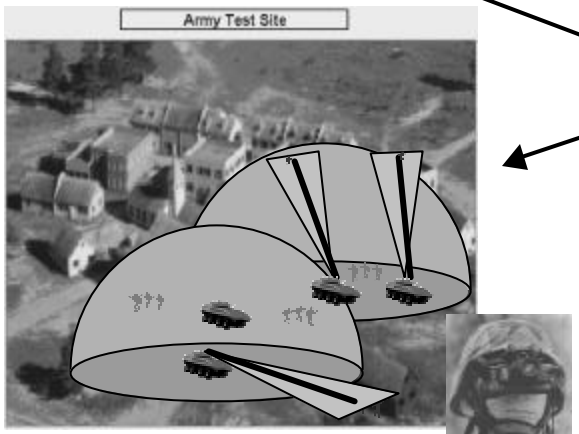
I^2 for Aviation

Standard

Low Halo

Symbology for the Aviator





I^2 for Driving

40^o x 100^o ANVG

Emerging technology first time incorporated into NVG devices

Helmet mounted FLIR adds IR for vehicle commander or dismounted soldiers

- Improved situation awareness and safety of flight with wide Field of View
- Added IR target detection capability for vehicle commanders and dismounted soldiers
- Integrated system of modular components provides Future Combat Systems Warfighter enhanced mobility, safety, use of on-board C4, lethality, survivability, and sustainability

Technical Challenges

Issues

- Current systems provide 40^{o} FOV; limited situational awareness
- I^2 only provides limited target detection capability
- Making the system HTI for Army applications

Approach

- Use of light weight wide FOV optics
- High resolution, low halo I^2 tube
- Integrated low cost, light weight uncooled IR camera for ground target acquisition applications
- Pursue a modular design that can adapt to both Air and ground requirements

ANVG ATD Execution Plan

Joint Army Air Force Program for I-PNVG/ANVG

- **leverage common Army/Air Force NVG requirement for rotary wing.**
- **Army will negotiate separate task with ANVG developer for completion of design and integration of full-up ground/dismounted soldier ANVG configuration**
- **Transition to PM NV/RSTA**
  - Aviation/Binocular Configuration 1QFY 03 for EMD
  - Technology Transfer of Ground with Thermal Camera Configuration 1QFY04
- **Technology Readiness Level (TRL) 7**

ADDED USER CAPABILITY FROM ANVG

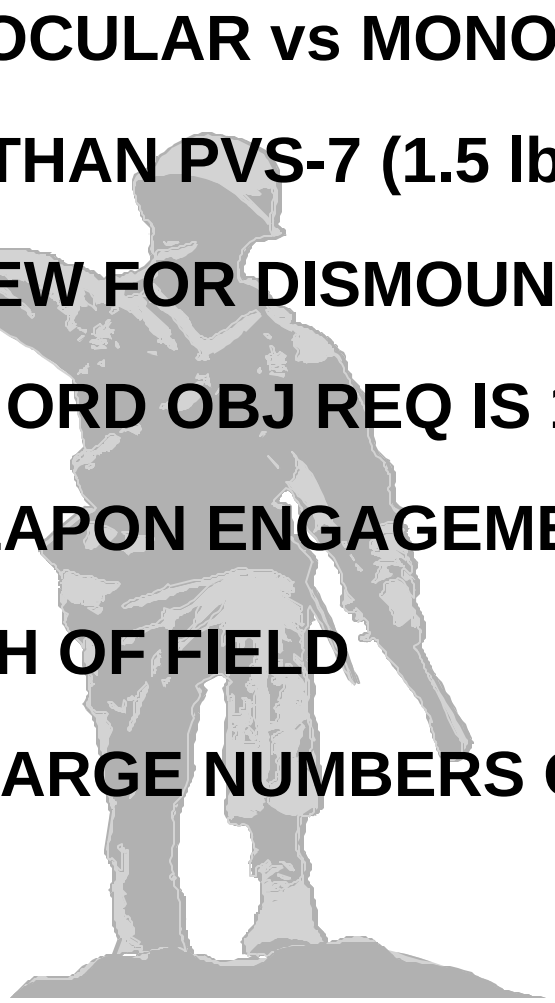
- Increased Resolution
- Wider Field of View

- Increased Safety
- Provides more visual cues for the pilot

- Increase Speed and Agility of night operations
- Ability to Fly Lower and Faster

- Reduced Pilot Workload
- Reduced Training Time

Owning the Night Issues

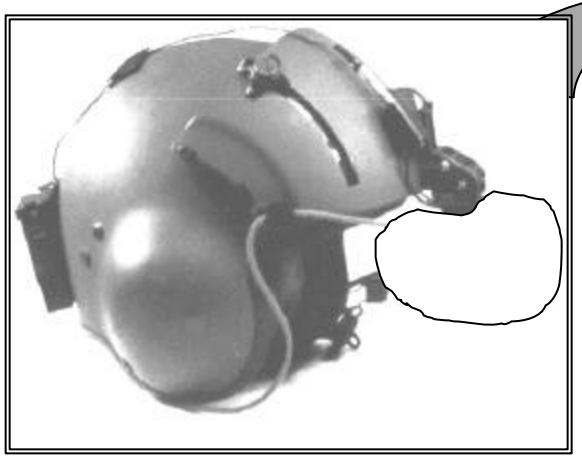


- BIOCULAR vs BINOCULAR vs MONOCULAR
- WEIGH NO MORE THAN PVS-7 (1.5 lbs/ 681 grams)
- BEST FIELD OF VIEW FOR DISMOUNTED SOLDIER
- (LAND WARRIOR ORD OBJ REQ IS 100° FOV)
- MOVEMENT vs WEAPON ENGAGEMENT
- FOCUS AND DEPTH OF FIELD
- COST PER ITEM: LARGE NUMBERS OF USERS

Advanced Night Vision Goggles Exit Criteria

Capability	Present (ANVIS)	Exit Criteria	
		Minimum	Goal
Cost	$7K/Unit	< $15K	< $12K(17K w/ FLIR Camera)
Wide FOV	40 degrees	40 x 100 degrees	40 x 100 degrees
Sensor	Visible (I^2)	Visible (I^2)	Visible (I^2) + FLIR (dismounted applications)
Resolution	20/40 High Light 20/120 Low Light	20/30 High Light 20/85 Low Light	20/24 High Light 20/70 Low Light
Display	Objective Lens HUD Symbology	Objectives Lens HUD Symbology	Integrate HUD Symbology + FLIR Insert (dismounted applications)
Weight / CG	734g (ANVIS viewer + HUD) USAARL Curve with Frangibility	< = ANVIS+HUD USAARL Curve with Frangibility	< 700g (950g w/FLIR) USAARL Curve w/o Frangibility
Power	2 AA Batteries, 30 hrs	2 AA, 20 hrs	2 AA, > 20 hrs
Eye Relief	18mm	25mm	30mm
Maintenance	Two-level	Two-level	Two-level

ANVG Design with HGU-56/P Helmet



Maintenance & Supportability

ANVG Design

- Incorporates Maintenance-Free Modular Components
  - Monocular Easily Removed Without Soldering
  - Sacrificial Windows
  - Evaluating the necessity for nitrogen purge
- Two-Level Maintenance Concept
  - Unit Level
    - Remove/Replace Monocular & Other Components
    - Gain adjustment
  - Depot/Contractor Level – Change Tubes, Optics
- Adapt Existing Field Test Equipment
  - AF – ANV-126
  - Army – TS3895

Advanced Night Vision Goggles Producibility/Program Risk

- **Leverage previous effort: USAF-PNVG**
- **Leverage on-going IR Camera development**
- **Maximize modular design concepts for Air Warrior, Mounted Warrior, Land Warrior and other dismounted applications**
- **Conduct human interface studies with HRED and USAARL**
- **Provision to adapt modular uncooled thermal or SWIR camera development for dual spectrum capability for dismounted applications**
- **Conduct cost versus benefit trade-off concerning IR FOV and resolution**
- **Incorporate display for symbology**
- **Provision to insert remote weapon sensor imagery**

Summary

- **ANVG ATD for all Army applications. HTI approach for aviation and ground.**

- **Awarded Phase 1 contract to develop ANVG for Aviation with capability to insert thermal imagery for Ground Users. Phase 1 ANVG delivery scheduled early FY02.**
- **Phase 2 will integrate for dismounted soldier, a helmet mounted, uncooled or short wave infrared (SWIR) thermal camera for target detection with the I^2. System delivery planned for FY04**

- **Payoff for warfighter in improved performance for pilotage, driving, and dismounted operations under night battlefield, adverse weather and MOUT conditions. Enhanced safety and situation awareness.**